BEAM PROGRAM

Program for Increasing Productivity and Efficiency in the manufacture and use of building equipment, accessories and materials.

PROGRESS REPORT

September 1969

Materials Branch
Department of Industry, Trade and Commerce, Ottawa.

THE BEAM PROGRAM

OBJECTIVE

The overall objective of the BEAM PROGRAM is to increase productivity and efficiency in the manufacture and use of building equipment, accessories, and materials.

SPECIFIC OBJECTIVES

After a study of the industry in Canada, the United States and abroad and after numerous discussions with representatives of the industry, its associations, and institutes, it was determined and agreed that increases in productivity and efficiency could best be achieved by meeting the following specific objectives:

1) The establishment of a comprehensive construction information system.
2) The adoption of modular coordination.
3) The greater industrialization of the building process.
4) The adoption of more uniform building regulations throughout Canada and the establishment of a means of assessing and approving new materials and techniques.
5) The establishment of an awards program to foster improved design in new materials, methods and techniques.

INDUSTRY ADVISORY COMMITTEES

The successful implementation of the program depends on receiving the support and participation of all levels of government as well as that of those directly concerned with the manufacture and use of building materials and equipment. After detailed consultations with representatives of these groups, the conclusion was reached that the fastest and most realistic way of obtaining industry's support and participation was through the establishment of industry advisory committees to assist and advise the Department of Industry on the various phases of the BEAM PROGRAM.

This concept received the support of all major industry associations and institutes, which agreed to participate in the formation of the committees.

Among the many advantages accruing from the formation of these industry advisory committees are:

- the benefit of the advice and support of industry and other experts in the development of each phase of the program,
- an excellent means of obtaining the active participation of the industry in the various phases of the program,
- bringing together a national cross-section of the various sectors of the industry to work together for their common benefit.

Three such advisory committees were formed and have been active. They are:

- The Industry Advisory Committee on Modular Coordination.
- The Industry Advisory Committee on Construction Information Systems.
- The Industry Advisory Committee on Industrialized Building Techniques and Systems.

The membership of these committees includes manufacturers, architects, engineers, university and technical college staff, specification writers, contractors, labour leaders, and representatives of government departments and agencies. Some forty-five industry representatives from across Canada presently serve on the various Industry Advisory Committees.

IMPLEMENTATION OF PROGRAM

Since the BEAM PROGRAM was conceived, considerable progress has been made in defining the needs of industry, initiating action, and identifying areas for joint government/industry cooperation.

Probably the most significant progress in the BEAM PROGRAM to date is in the excellent results that have been achieved in obtaining the support and participation of industry, the design professions and their associations and institutes in the purpose and objectives of the program. In view of the size of this industry, its varied interests, fragmented nature, and diversification, this is believed to be a major achievement.

The main features of the program, the courses of action advocated and supported by the Industry Advisory Committees, and the progress to date, are as follows:

CONSTRUCTION INFORMATION SYSTEMS

A flood of information is being disseminated from a multitude of sources about such matters as new building techniques, materials, products, machinery and equipment, and a variety of other relevant topics. This information, much of which is essential to decision making, is not now readily available in a sufficiently organized manner to permit the industry to use it effectively. In fact, a great deal of available information on the latest developments in construction materials, products, and systems, does not reach the decision maker. The problem is not only one of being informed of the many new improvements in products, techniques and processes which can substantially improve productivity and cut costs, but also of having a knowledge of the many products and materials being withdrawn from the market. Present efforts to catalogue, maintain, and subsequently retrieve information of this kind are not adequate, with the result that productivity and efficiency are suffering through lack of up-to-date knowledge. An information system that would provide an efficient service for collecting, organizing, and disseminating information related to building is, therefore, being carefully studied at the present time.

- Studies have been made on the need, requirements, and services of a construction information system. Guidelines for the operation of such a system have also been established.
- Visits to the major construction information centres in the United States and Europe were made by a consultant, and an officer of the Department. A comprehensive report was prepared and made available to interested parties in Canada. This report, along with our previous studies, formed the basis for our subsequent activities in this field.
- An Industry Advisory Committee on Construction Information Systems was established in February 1967, and it has met regularly since then.
- The committee has reviewed the work previously done by the Department and other reports and material available on this subject. As a result of this, it was recommended that a study be undertaken to determine the precise needs and priorities for construction information, to identify the possible ways in which a comprehensive and flexible information system could be developed, and to enable government and industry to assess the feasibility of establishing such a system in Canada.
- A firm of consultants was retained to undertake this study in the course of which over 10,000 companies and individuals were questioned by mail and nearly 100 were interviewed personally. The consultants' findings resulted in the submission of a report to the Industry Advisory Committee and the Department.
- After review and discussion of the findings of the survey the committee formulated two resolutions:

1. "That the Industry Advisory Committee on Construction Information systems recognizes the need for a practical information system for the Canadian construction industry and requests the Federal Government to do all it can to foster the establishment of such a system."
2. "This committee recommends to the Minister of Industry that his Department develop the specific requirements for the establishment of a comprehensive Construction Information System. The committee further recommends that in conjunction with industry groups, the Department establish a means of introducing and financing the system as a continuing and expanding service."

As a result of these resolutions, guidelines were established, general performance factors developed, and a future course of action suggested.

Guidelines

- The role of the Department of Industry should be that of a catalyst that will exhibit initial leadership, guidance and assistance in the development and establishment of a comprehensive construction information system.
- The Department of Industry should develop the performance specification for the establishment of a comprehensive construction information system.
- The Department of Industry should actively seek, in association with industry, the formation of an independent, non-profit, financially responsible corporation (or similarly constituted body) having a board of directors representative of the various industry sectors and government.

- This corporation should have the authority and financial ability to establish, operate and provide for the continued development of the construction information system.

General Performance Factors

In developing a performance specification for a comprehensive construction information system, the following needs of the potential users should be considered. The information needs are:

a) products,

b) codes, standards and specifications,

c) technology,

d) commercial data.

Any comprehensive system should provide some means of eventually satisfying all of these user needs.

In developing the system, the planner should also consider that the user must have:

a) most of the information he regularly needs on hand,

b) a secondary source of information with easy access,

c) an easy means of searching for what he needs,

d) an ability to question the system when he does not know what his exact requirements are.

The system must also provide:

a) a simple language for communication,

b) an acceptable vehicle for the transmission of information, and

c) a compatible framework for its management and operation.

Suggested Course of Action

In order to ensure that an efficient and effective construction information system is developed, it is suggested that the Department of Industry, Trade and Commerce with the assistance and advice of the Industry Advisory Committee, undertake the following program of activities:

1) In association with the manufacturers, review the existing formats and media for the dissemination of construction information in the printed form and adapt these to the requirements of a comprehensive information system.

2) Retain consultant(s) to work with the Department and industry associations in preparing a thesaurus of technical terms applicable to building equipment, accessories and materials, in developing a method of coding and indexing compatible with the construction information system and acceptable to the industry and in undertaking any other tasks connected with the establishment of the system where Departmental manpower resources are unavailable.

3) Undertake the necessary steps to establish a means of financing, administrating and managing the system.

4) Develop the marketing techniques that will ensure the participation of the users.

5) Develop an information system prototype model involving a limited number of both users and suppliers of building product information, that will simulate the activities of a national system. The methods, techniques, and equipment to be employed will permit an assessment of the economic and technical factors inherent in an operating system.

6) After a trial period, evaluate the model's effectiveness and capabilities.

7) Utilizing the results of the study on the prototype, prepare a performance specification for the consideration of interested parties.

The Department has retained consultants to undertake the development of two major tasks essential to the implementation of the system. These are:

- The preparation of a thesaurus of construction product terms (structured key word vocabulary) for selecting descriptors in a construction products information system. This thesaurus will contain:
  a) Thesaurus of terms authorized for use in the system, indicating relationship among these terms and defining the extent to which they are required.
  b) Indexes to the thesaurus of terms. To be included or developed as required for the effective use of the thesaurus of terms. Possible types of indexes for the thesaurus are: Alphabetical product index, permuted index, Building Construction Index (S.W.A.), faceted, and hierarchial.
- The development of a performance speficiation for the establishment of a viable national comprehensive information system to meet the needs of all individuals, companies and associations concerned with construction in Canada. As part of his tasks, the consultant will be required to establish and operate an experimental model for evaluation and testing purposes.

Concurrent with these two activities a study is underway in cooperation with the Specification Writers Association of Canada to develop a standardized method of presenting technical product information. It is hoped that with the cooperation of manufacturers this will be accepted on an industry-wide basis and be an integral part of the information system.

Studies will also be undertaken to develop a means of organizing and marketing the system.

It is anticipated that all these development phases will be completed by mid 1970 and result in the establishment of a comprehensive Construction Information System.

MODULAR COORDINATION

Modular coordination or, as some prefer, dimensional coordination, are synonymous terms given to the process of standardizing the dimensions of building components so as to reduce the variety of sizes in which components are manufactured and thus facilitate the assembly of components on the building site with a minimum of alteration. Dimensional standardization based upon the standard 4" building module is a prerequisite to coordination. The modular concept is not new, but while receiving intellectual endorsement it had never enjoyed as broad application in Canada as it has in other countries. It is an important means of increasing productivity and efficiency in the manufacture and use of building equipment, accessories, and materials and, as such, deserved inclusion as an integral part of the BEAM PROGRAM.

Dimensional coordination provides a way to reduce costs in traditional building methods and it is a necessary prerequisite to the industrialization of the building process. It is a fact that no real industrialization is possible without standardization and, in the building industry, no standardization is possible without systematic dimensional coordination.

The main advantages of modular dimensional standardization and coordination are as follows:

a) The need for manufacturing and stocking components in more than one standard range of sizes is eliminated, thus inventory is reduced and simplified.

b) The mass production of building components is made possible, resulting in increased economies of scale.

c) Architectural and engineering design is facilitated, production time for drawings shortened and their clarity and utility increased. Costly procedures related to the production and function of shop drawings may be eliminated. Resulting economies in time and costs can enable the design professions to deal with a greater volume of work, and thus extend their effectiveness to the building industry.

d) Estimating and pricing of work is easier and more accurate.

e) Site layout is simplified.

f) Supervision of construction is more efficient.

g) Workmen understand their assignments better and work is performed with greater ease and rapidity.

h) Waste of materials is held to a minimum.

i) Job and site cutting of building materials is reduced or entirely eliminated.

j) The orderly and intelligent development of the industrialization of the building process is facilitated.

In order to promote the use of modular coordination as a means of increasing productivity and efficiency, the following activities were initiated:

- Studies of work done on modular coordination in Canada and elsewhere were made.
- The advantages of modular or dimensional coordination to the manufacturer, to the architect and engineer, to the contractor and to the owner and developer were established.
- Modular coordination was discussed with representatives of industry, their associations and institutes, and with government departments and agencies, and reasons for its general lack of acceptance determined.
- An Industry Advisory Committee on Modular Coordination was established in February 1967, and has met regularly since then.
- After a complete review of the subject, a program aimed at promoting the adoption of modular coordination was developed in association with the committee.
- Six regional conferences on modular coordination were held in Halifax, Toronto, Winnipeg, Edmonton, Vancouver, and Montreal in October and November 1967. These conferences were attended by about 1,000 senior representatives of the architectural, engineering, and teaching professions, manufacturing and contracting industries, and representatives from all levels of government. The conferences were highly successful and received strong support from all sectors of the industry, and from their national and provincial associations and institutes. Four internationally known experts addressed each conference on the relationship between Modular Coordination and the manufacture and assembly of building materials and components to the industrialization of building, the building contractor, and the designer. The lectures were followed by panel discussions and the lively and intelligent audience participation indicated a high level of interest. The proceedings of the conferences have been published and distributed widely to industry. Copies are available upon request.

- As a necessary follow up to these conferences, a series of clinics designed to instruct the design professions, contractors, draftsmen, etc., on the application of modular practice, has been organized. More than 80 have been held to date (April 1969) in all parts of Canada and have attracted approximately 3500 participants. In this way a broad representation of the building industry has received a good working knowledge of the modular discipline.
- A directory of modular building materials and components now manufactured in Canada has been published. This directory is being distributed to the design professions and industry and will facilitate the specification and use of modular products. Also, since the directory will be revised each year, it will serve as a means of measuring the growth of the application of modular coordination in Canada.

It is encouraging that this aspect of the BEAM PROGRAM is receiving considerable support from other Federal Departments and Agencies concerned with building. The Department of Public Works now requires that all new buildings commissioned by the Department will be designed to modular standards. This leadership and initiative demonstrated by D.P.W. has been enthusiastically received by the building industry and its professions. Central Mortgage and Housing Corporation also endorses the concept of modular coordination. The Division of Building Research of the National Research Council, long an advocate of modular coordination, has, in this regard, given invaluable assistance and support to the BEAM PROGRAM initiatives. The Departments of National Defence, Indian Affairs; and Northern Development and Transport have also demonstrated their support of the modular concept.

Among Provincial Governments now applying modular coordination especially in their Departments of Public Works are those of New Brunswick, Quebec, Ontario, Saskatchewan and British Columbia. Other Provincial Deputy Ministers of Public Works and Provincial Chief Architects are known to be interested and will, in all likelihood, implement the recommendation accepted at the 1968 annual meeting of the Provincial Deputy Ministers of Public Works ".... that modular coordination be adopted as soon as possible....".

INDUSTRIALIZED BUILDING TECHNIQUES AND SYSTEMS

The components and materials for building have traditionally been brought to the site in an unfinished state to be cut, shaped, fitted, and finished by craftsmen. The evolutionary changes beginning to take place point to the eventual development of a strong, capital-intensive, factory-based industry which will be much less affected by weather conditions. More and more components will be delivered to the site in a finished or nearly finished condition. This evolution is generally referred to as the industrialization of building.

Industrialization of building construction implies:

a) continuity of production;

b) standardization;

c) integration of the different stages of the whole production process;

d) systematic organization of work;

e) mechanization wherever possible;

f) research and organized experimentation.

It involves the use of new techniques and new materials, as well as the use of traditional materials in new ways. For its fullest exploitation,

it must also include new methods of coordinating the building requirements of clients and new contractual and working relationship between clients, architects, builders, manufacturers, and labour.

Canada's climate is such as to make it one of the most logical areas for the adoption of industrialized building techniques. With this factor in mind, the following objectives are being pursued:

a) the creation of an environment which will be conducive to the development of new industrialized building techniques;

b) the orderly evolution and implementation of industrialized building techniques and systems;

c) encouragement to manufacturers of building equipment, accessories, and materials to develop standard building components for industrialized building;

d) the promotion of a systems approach to building.

In order to realize these objectives the following activities were initiated:

- Studies of building systems development in both Canada and abroad were made.
- Technical missions have been organized to study industrialized building techniques in Europe and their implications for Canada, and the following Reports have been published: "The Use of Prefabricated Masonry in Industrialized Building in Europe", "The Use of Prefabricated Concrete in Industrialized Building in Europe" and "The Use of Prefabricated Steel in Industrialized Building in Europe". These missions were highly successful and well received by the industry.
- Officers of the Department have visited the United States and Europe to talk to experts in the field of industrialization and a systems approach to building and to attend international conferences on these subjects.

- An Industry Advisory Committee on Industrialized Building Techniques and Systems was established in February 1967. The committee has been active since its inception and has made a major contribution to the BEAM PROGRAM and to the industry by strongly stating that an orderly, efficient industrialization of the building process cannot take place without first considering the development of an overall systems approach to building, of which industrialization is only a part. Since the concept of a systems approach to building is so important and so little understood or applied in Canada, the Committee, after much consideration, unanimously recommended that a National Conference on a systems approach to building be held. It was their belief that such a conference, the first of its kind in Canada, was urgently required by all sectors of the industry.
- The Department in cooperation with the Canadian Construction Association, the Royal Architectural Institute of Canada and the Association of Consulting Engineers of Canada organized a National Conference on "A Systems Approach to Building" in Ottawa on April 29-30, 1968. The Conference attracted more than 500 senior representatives from the construction industry and the design professions as well as a number of international authorities. The Conference covered such subjects as "The Need For a Systems Approach to Building", "The Role of The Designer Team in Developing a Systems Approach", "The Manufacturer/Contractor and a Systems Approach" as well as case studies on housing and school construction by international experts from Scandinavia, Britain, the U.S.A. and Canada. The lectures and proceedings of this Conference have been published and widely distributed.

BUILDING CODES AND STANDARDS

The basic purpose of a building code is to protect public life, health, and property, by ensuring proper standards in buildings for safety, health, and general welfare.

Standards for building products state their desired or required characteristics. These may be stated in the form of composition, methods of manufacture, and appearance, or the way in which the installed article should behave under given conditions. The most progressive approach is that of "performance" standards which state what is required of the material or products, rather than how it is to be made. This permits much greater flexibility in application and future revision.

Univormity in building codes and a greater number of adequate standards would improve the efficiency and productivity of the construction materials industry by facilitating the introduction of new materials and systems, and by making the erection of new buildings more efficient and less costly.

The more serious problems in establishing uniformity in codes and standards in Canada are:

- The multiplicity of uncoordinated building codes in municipalities across the country;
- The fact that some of these are out of date, unduly restrictive and/or of low technical quality;
- The lack of nationally enforced standards and particularly performance standards for building materials and components;
- The need for better and more efficient means of assessing and approving building materials, systems, and methods.

The authority for providing and administering building codes in Canada rests with each individual municipality, although some specialized factors may be under provincial and/or national jurisdiction. Since the desires and technical abilities of different municipalities vary widely, so do their codes. The preparation of such codes involves repetition of work and duplication of effort which is expensive, time consuming and unnecessary.

This situation creates confusion and uneconomic conditions for manufacturers seeking to introduce new materials or systems which are not clearly covered by the existing codes or standards. They must acquaint themselves with the varying requirements of local codes and diversify their operations and products to meet the many variables within these codes, or else they must restrict their operations to selected regional markets. Such a condition is a restraint on economic growth because it adds to costs and narrows the market for Canadian building products and materials.

The high cost of researching, testing, maintaining, and servicing of the many different building codes is wasteful. The absence of adequate standards, or in some cases any standards for many products means manufacturers and users are left in a position of uncertainty which inhibits their operations. This situation is inefficient and wasteful and seriously affects the productivity of the industry.

The ideal would be to have a modern, uniform code with a complete set of complementary performance standards, including provisions to meet differences in regional climatic or other conditions, and a recognized authority to juege and certify conformity to it. This would simplify and make more efficient the introduction of new materials and new building systems.

Such a code exists in Canada - the National Building Code. This excellent code is promulgated by a representative national committee of experts in their respective fields, but essentially developed and serviced by the Division of Building Research of NRC. This code is made available for use by local authorities. There are also abridged versions available for smaller communities. A special compilation of Residential Standards has also been developed which has been adopted by Central Mortgage and Housing Corporation for residential construction. Authorities may adopt this code in total or in part, with modifications or amplifications, or use it as a basis for development of their own code. The National Building Code has gained much acceptance across Canada. A much wider, complete, and more rapid adoption of this code and of its periodic revision is, however, urgently required.

The adoption of industrialized building techniques would be greatly facilitated by the introduction of uniform building regulations, the development of performance standards, and the establishment of a means of assessing new building materials, systems, and techniques.

All of the above problems, which are fully recognized by government and industry, can be overcome and better economic conditions attained by:

- Fostering the adoption of the National Building Code throughout Canada with a minimum amount of modifications;
- Establishing a national program to produce performance standards;
- Creating an acceptable means for the proper assessment and certification of new products and systems which meet the code and standards requirements;
- Establishing training programs to produce greater numbers of component personnel to carry out the local enforcement of the code.

The main effort to date in this part of the BEAM PROGRAM has been to draw attention to the above needs. Through conversation and speeches there has been created an increased awareness in Canada of the effect that uniform building regulations have on the productivity and efficiency of the industry. Also, support of the National Building Code has had useful results.

At the request of and in cooperation with the Specification Writers Association of Canada and CGSB, the Department is compiling a comprehensive index of construction standards, codes and specifications usable in Canada. This index will be revised periodically and incorporated into the proposed information system and will be of considerable value to both industry and government. Other government departments have also assisted in the study.

INDUSTRY DESIGN PROMOTION

While experience shows that the development of improved construction products depends largely on technological advances, it has also demonstrated that the commercial success of new products is also dependent in many instances on sound industrial design.

In the past the Department has organized, in cooperation with the concerned associations, design award programs recognizing the creative use of materials in buildings and bridges.

A Canada-Design Awards Program is being initiated which will continue this program but which will also recognize design excellence in the development and application of new building equipment, accessories, and materials and in the improvement of existing components. The program will recognize especially those designs which incorporate the principles of modular coordination, prefabrication, pre-assembly, and standardization of components.

The purpose of this program is to encourage Canadian designers and manufacturers of building materials and products to take full advantage of design as a means of increasing productivity and efficiency.

PARTICIPATION AND SUPPORT

1. Industry

The BEAM PROGRAM was conceived in cooperation with the industry. Prior to the formulation of the program, discussions were held with representatives of major associations and institutes concerned with the various aspects of building.

As a result of these meetings, the main objectives of the program were identified and the concept of the Industry Advisory Committees emerged.

Since the announcement and implementation of the program, all sectors of the industry have constantly supported the various activities associated with the program as attested by:

- An encouraging response to the survey undertaken as the initial phase of the feasibility study on Construction Information Systems.
- Excellent attendance and enthusiastic participation by some one thousand senior management representatives at the six regional conferences on Modular Coordination, and by over 500 at the National Conference on "A Systems Approach to Construction".
- Numerous letters of endorsement from all sectors of the industry in connection with the above events and in response to the publication of the BEAM Bulletin.

All indications point to continued industry support for the clinics on modular practice, the publication of a directory of modular building materials, as well as for the industry design promotion program.

2. Federal Government

The following Federal Government Departments and Agencies have been involved in the BEAM PROGRAM since its inception:

- Department of Industry, Trade and Commerce
- Department of Public Works
- National Research Council/Division of Building Research
- Central Mortgage and Housing Corporation.

Representatives of the above Departments and Agencies serve as members of the Industry Advisory Committees.

Because of the volume of construction generated by the Federal Government, it is essential that they continue to provide leadership to all those concerned with increasing productivity and efficiency in the building industry.

3. Provincial and Municipal Government

The objectives of the BEAM PROGRAM have been outlined and discussed with senior officials of each of the Provincial Governments.

The provincial and municipal authorities have shown a vital interest in this program to increase productivity in the manufacture and use of building equipment, accessories, and materials both in their role as administrators and in their role as major users of construction materials and services.

Only through the support, cooperation, and assistance of all sectors of the industry and of all levels of government can the objectives of the BEAM PROGRAM be fully achieved and the costs of building be favourably influenced through greater productivity.